Scoping Secure Online Shopping for Older People

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1. INTRODUCTION

Many people have an impairment of some form or other that makes standard security solutions particularly difficult for them to use. As previous work has shown [8, 7], the range of possible relevant impairments and conditions that designers need to consider is vast. Within the accessibility field, researchers have been using epidemiological and other large survey data to get a better overview of what key impairments are, and how frequently they occur in the target population for a piece of technology or software [6, 11, 12].

Large surveys cover many different types of abilities. They are often designed to be representative of a population and include mechanisms to adjust for non-responses. Therefore, for each of the abilities and the ability levels they cover, they allow analysts to estimate how widespread certain impairments are, and how many people will be excluded from a user interface that requires particular ability levels, e.g. a level of corrected vision that is good enough to read newsprint.

Unfortunately, due to the large sample sizes, many abilities are only characterised superficially, if at all, and the cost of interviewing and testing time means that some or all data will be self-reported. For interaction design, that is not necessarily a drawback, since self-reported ability affects whether people are likely to attempt a task in the first place. For example, somebody who thinks that their vision is poor may shy away from CAPTCHAs or a complex web page with many small elements.

In this paper, we argue that reanalysis of epidemiological data can help us design security solutions that are easier to use for more people. We focus on older people who may have problems with getting out of the house, which makes them good candidates for online shopping. As our data set, we use the English Longitudinal Survey of Aging (ELSA, [2]). Although ELSA does not contain detailed assessments of sensory abilities, it provides a comprehensive view of people's socioeconomic context, which is just as important to accessible design—security needs to be affordable. If a particular mobile app for shopping only works on a premium tablet or phone, it may be unusable by many people.

Our analysis proceeds by identifying three key quantities:

1. How many older people can benefit from online shopping due to mobility restrictions?
2. How many of those people identify as having vision and potential motor problems (arthritis) that makes it hard to type, press buttons, read captchas, or produce swipe gestures?
3. What appliances or technology do these older people own through which online shopping could be facilitated?

In Section 2, we introduce the ELSA data set. Results are summarised in Section 3, and preliminary implications for design are discussed in Section 4.

2. THE DATA

The English Longitudinal Survey of Ageing (ELSA) follows the lives of over 8000 people from England as they age. The initial sample was designed to be representative of the demographics of older people in England. Participants are contacted every two years. Each contact is called a *Wave*. While the overall structure of the survey remains the same, the detail of data collected varies from Wave to Wave. The extensive data covers health, social life, financial aspects, and overall wellbeing [4]. Of particular interest here is the definition of *wealth group* [10]. In order to establish wealth groups, all respondents were grouped by total family wealth, excluding pensions, and divided into quintiles. The lowest quintile in Wave 5 owns less than £50,000, while the highest quintile owns more than £440,000.

As part of the ELSA questionnaires, all participants were asked about getting to a corner shop (in the UK, a small neighbourhood shop), a supermarket or a shopping centre. The options were "very easy", "quite easy", "quite difficult", "very difficult", "unable", or "do not want to".

In different parts of the survey, participants were asked whether they owned a PC or a digital TV (online TV), whether they used the internet and/or email, and whether they had a mobile phone. No data about frequency of use was collected.

Participants were also asked about selected chronic health conditions which were of particular interest ot health care researchers. The condition particularly relevant here is arthritis, which can severely impair both mobility and dexterity. Although there were many questions that probed eye-related health problems, the item we chose for our analysis is a self-report item, namely the ability to read newspaper print. Of all the items from ELSA, this one translates most directly to whether people think they might be able to read CAPTCHAs or interact with overly-complex shopping pages.

3. RESULTS

Before delving into detailed results, let us look at some insights that can be derived from published summary tables

Table 1: Ability to go shopping

Criterion	Corner Shop	Supermarket	Shopping Centre
Very/quite easy	85.2%	90.6%	82.7%
Very/quite difficult	4.7%	5.2%	8.9%
Unable	1.1%	1.4%	1.0%
Unwilling	2.5%	0.6%	2.0%
No answer	6.5%	2.7%	5.1%

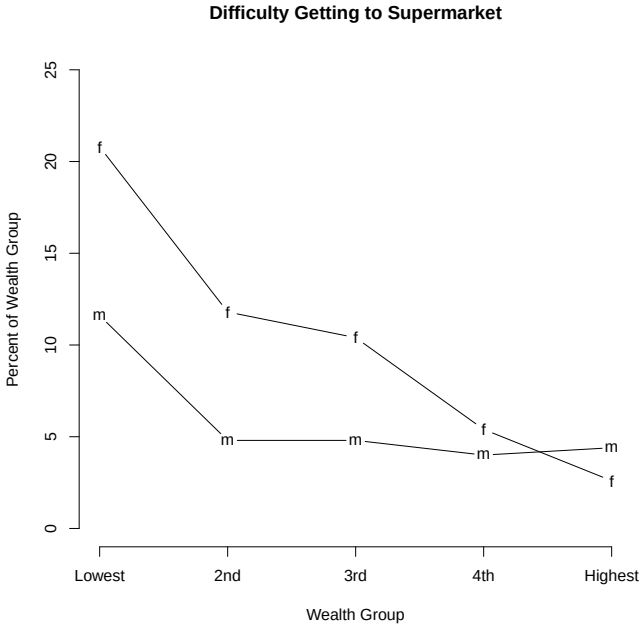

Figure 1: Problems shopping at a supermarket across wealth groups. f=Women, m=Men

of the whole data set. In the following discussion of the summary tables, we will quote percentages that have been adjusted for non-response.

Overall, the discrepancies between wealth groups are almost as substantial as the differences between age groups, and there is often a clear gender gap, with women being more limited in their daily activities, and with less access to technology.

For example, 33.8% of men and 29.0% of women in the lowest wealth group use internet and/or email, as opposed to 84.9% of men and 74.9% of women in the highest group. In the age bracket 55-59, 81.6% of men and 79.1% of women are online, in the oldest age bracket (80+), this is reduced to 27.9% and 9.6%, respectively [9, Tables S4a, S4b].

Although at first glance, these numbers appear low, when comparing data across Waves [9, Tables SL2c and SL2d], we see that internet use is spreading. People who used the Internet in 2002 (Wave 1) are highly likely to be still using it in 2010, when the Wave 5 data were collected, and people from all ages and wealth groups pick it up, even those aged 75 or older [9, Tables SL2c, SL2d]

When it comes to shopping, more women than men find it hard to get out to shop [9, Table S8a], and there are substantial discrepancies across wealth groups, as shown in Figure 1, which is based on Table S8b [9].

Impairment is not just confined to people aged over 65. A quarter of all people aged 55-59 already have a long-standing illness that limits their daily life [13, Table H2a and H5a], and one in ten report that they are limited in activities of daily living. For people aged 75+, these percentages double and triple—around half have long-standing illness and one in three is limited in ADL (Activities of Daily Living).

For a more detailed analysis, we excluded those from the original data set ($N = 10274$) for whom the shopping related questions were not applicable, those who were not interviewed in person, and those who were younger than 50. The remaining 8720 people have a mean age of 66.5 years (SD: 9).[1] 44.4% of the sample are male, 55.6% female, which reflects the higher mortality rate of men.

While most people in the sample can at least get to a supermarket, for one in ten, even that is difficult or impossible (cf. Table 3). Those people are older (mean age: 72, $p < 0.0001$, Wilcoxon test) and more likely to be female (odds ratio 1.6, 95% confidence interval [1.4-2.0], Fisher Test). They are also more likely to report that their eyesight is only fair or poor (OR 3.5, 95% CI [2.9-4.3], Fisher Test), to have a form of arthritis (OR 2.6, 95% CI [2.2-3.1]), and to have problems with dressing themselves (OR 5.9, 95% CI [4.9-7.1]).

Even though those people who find it hard to get to a supermarket are also far less likely to have a digital television (OR 1.4), own a PC (OR 2.4), have a mobile phone (OR 3.6) or use internet or email (OR 3.7), they are not completely digitally excluded. 61.1% have a mobile phone, PC ownership stands at 42.2%, 34.8% have a digital television, and 30.1% use the internet and/or email.

4. DISCUSSION AND CONCLUSIONS

The data show that those who would benefit most from safe, usable online shopping are those who have reduced mobility and poorer self-reported vision. This is significant for the design of shopping apps and web sites: not only in the layout and appearance, but also in the security features which need to work for people with poor visiton.

While much work on accessible security has focused on the blind and visually impaired, our analysis of the ELSA data highlights the mobility and dexterity impairments caused by arthritis as key concern when creating usable security for older people.

CAPTCHAs are one of the first hurdles, usually used in the account registration phase when a user first signs up at a site. The lack of accessibility and usability problems of CAPTCHAs have been pointed out by the W3C and by now studied by a number of researchers (e.g., [1]) and they remain problematic.

Once a user has an account, they will need to log in and authenticate. Assuming a user who has the ability to recall a good password, typing it may still be problematic, especially if the shopping site has complex password rules requiring the use of special characters: special characters may be difficult for visually impaired users to distinguish from ordinary ones (on the screen or when written on reminder notes), and they are often harder to type, requiring shift keys on physical keyboards, so more difficult for users with arthritis.

[1]To ensure anonymity, all respondents over 90 are collapsed into age 89 in the ELSA dataset.

Further security "features" intrude during the online shopping experience, that may disadvantage people who are visually impaired or find it hard to type. For example, web site accounts may automatically log-out, forcing the user to repeat the login process. Finally, the payment step often requires a third authentication mechanism involving a bank.

Recent developments in hardware may eventually allow web sites to simplify authentication mechanisms by using biometric authentication (e.g., the fingerprint sensor of the iPhone 6), but those who need support the most are also least likely to be able to afford state of the art technology. While the use of technology is spreading, even among less wealthy older people, the hardware that solutions will need to run on is likely to be older, slower, with smaller resolution screens, and cheaper. Smartphones and tablets are likely to be low-specification Android models. Apart from technology limitations, older devices are more likely to become at risk over time to security breaches (by malware, unavailable or uninstalled operating system updates, etc.), so older users of older devices and operating systems are hurt doubly. Clearly, inclusive usable security means not just designing for people with varying levels of ability; it also means designing for the lowest common technological denominator. It means providing security measures that are as robust as possible when running in environments that may be compromised.

As further work, the survey data analysis suggests there may be value in a targeted study concentrating on users with visual impairments or arthritis, comparing different web site shopping experiences. As far as we know, there have not so far been any similar openly published comparative studies. Such a study would combine in-depth usability evaluation and quantitative scales (e.g. [5]) with in-depth interviews exploring attitudes to and experience with technology, as well as people's perception of their own ageing process.

Finally, we see an interesting gender difference. Women are more likely to require help with shopping, in particular those in lower wealth groups, but at the same time, they are more likely to be technologically excluded. We suggest that feminist analysis [3] can be helpful in exploring the possible reasons for these findings. Women (in particular in lower wealth groups) might have less access to transport, or be more likely subscribe to common tropes about technology being a male domain. Hypotheses that refer to finance, social networks, transport, or overall self-efficacy can be tested using the ELSA data, while those that explore social perceptions of women as users of technology might be better suited for ethnographic work.

In conclusion, making security usable and accessible is about more than impairment—it requires a holistic view of the person, their abilities, and their resources.

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